

Heat-Recovery Cokemaking Presentation

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Sun Coke Co.

Sun Coke Company

- Sun produces high quality blast furnace coke using the Jewell-Thompson Heat-recovery ovens
 - No production of significant quantities of toxic chemicals
 - Allows for power generation
- Developing a Foundry Coke Product



Sun Coke Co. Operating Units

- **Jewell Coal & Coke Co.,**

Vansant, Va.

35+ years of operation

142 Ovens, 0.7 MMTPY

Partial Heat Recovery and Flue Gas Cleaning

- **Indiana Harbor Coke Co.**

East Chicago, IN

1998 Start-up

268 Ovens, 1.3 MMTPY

Full Scale Heat Recovery (94 MW cogeneration plant)
and Flue Gas Cleaning

History of the “Jewell” Coke Oven

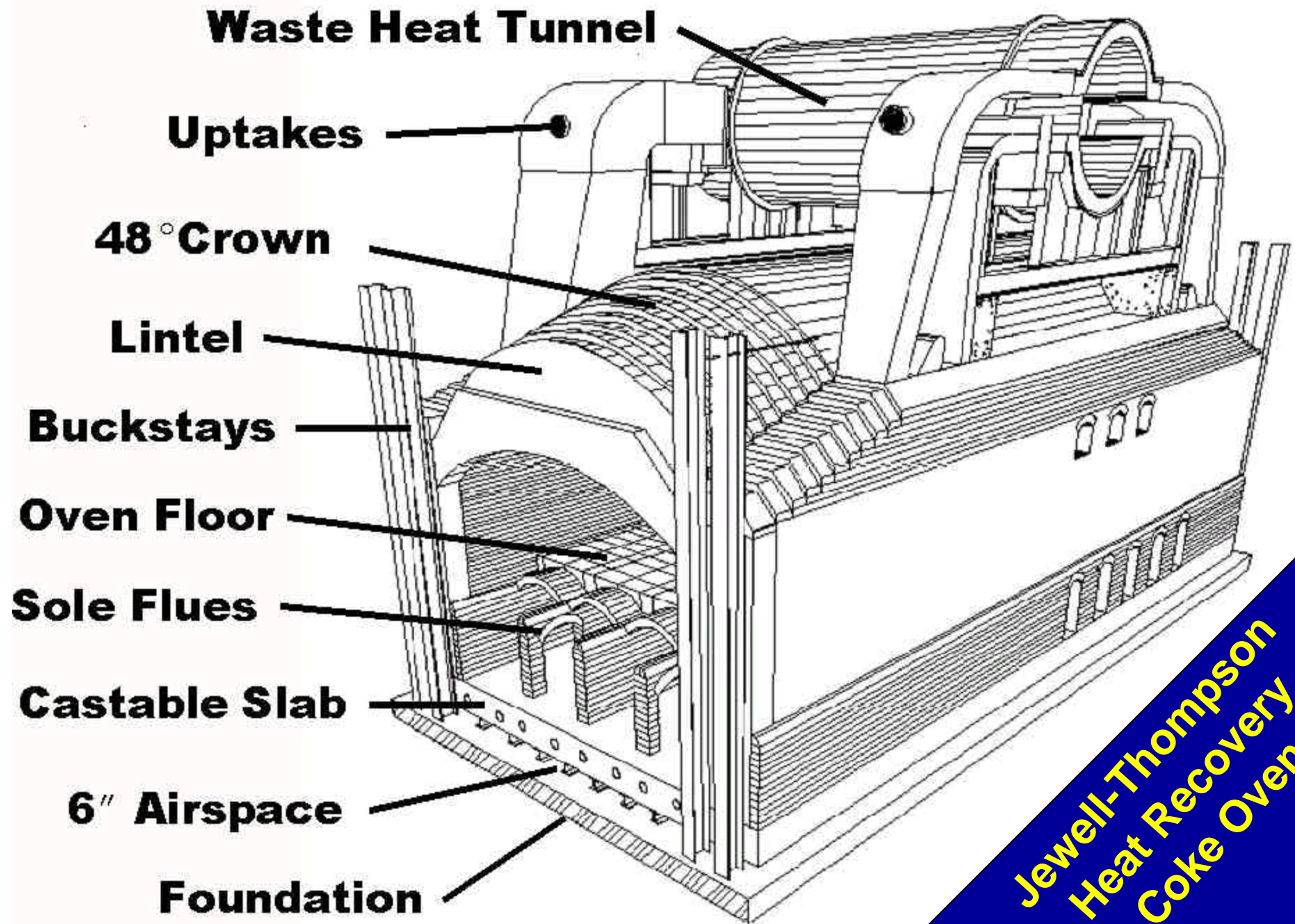
- Jewell oven traditionally referred to as non-recovery cokemaking
- Ovens at Jewell & IHCC are 5th generation designs with over 20 batteries built and operated - improvements carried forward each time
- JC&C in Vansant, VA has operated present design for since 1989

Jewell Coal & Coke Co.



Indiana Harbor Coke Co.





**Jewell-Thompson
Heat Recovery
Coke Oven**

Visual Observation of Coking Cycle



Freshly Charged Oven



Partially Coked Out Oven



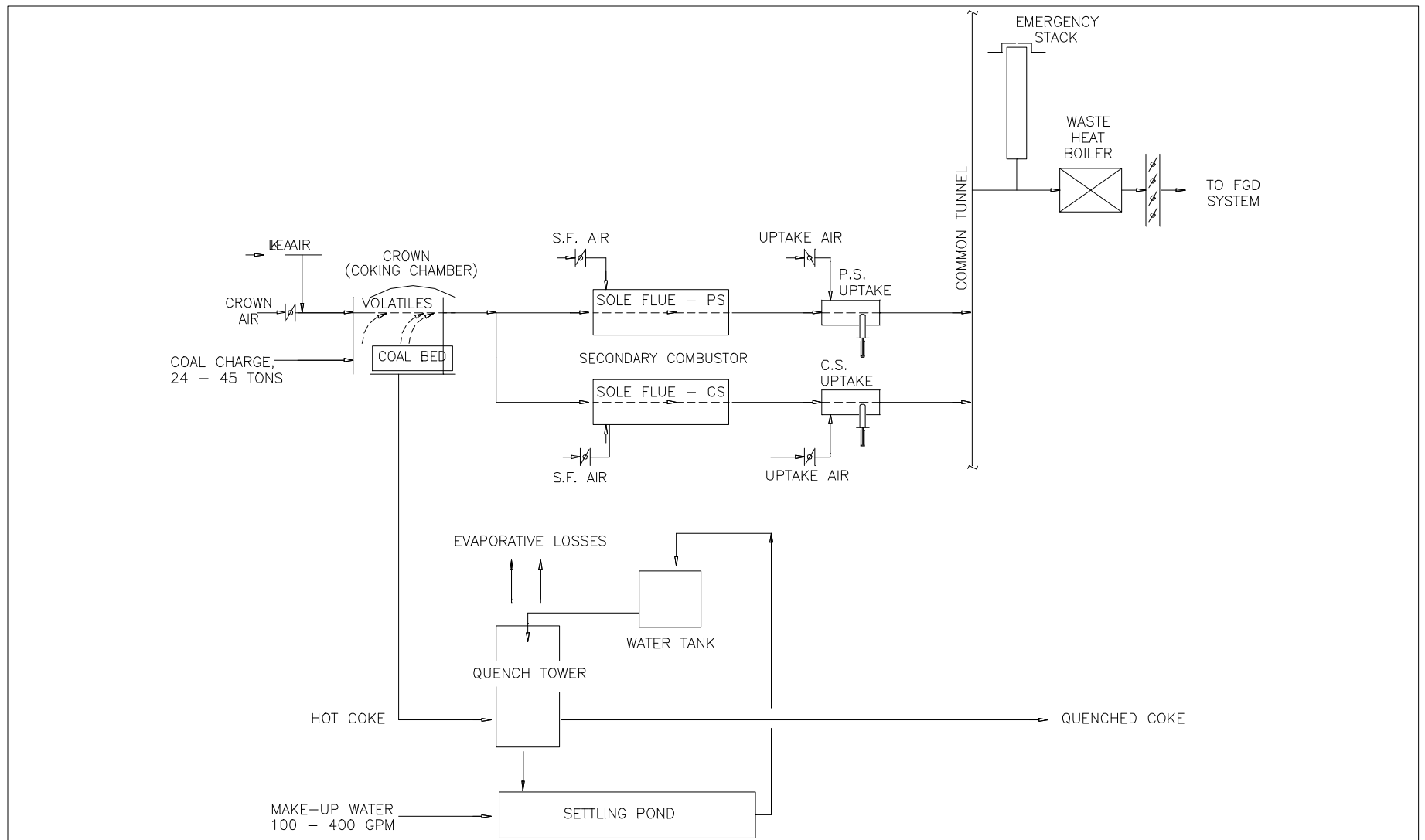
Fully Coked Out Oven



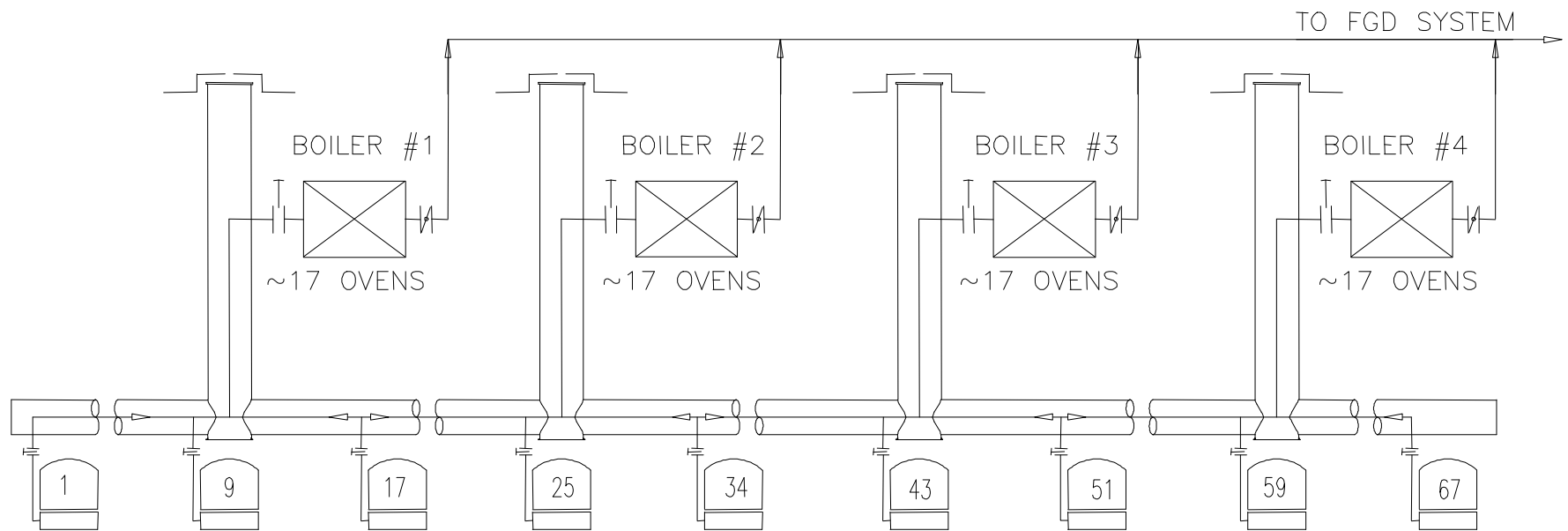
Heat Recovery Facility at IHCC



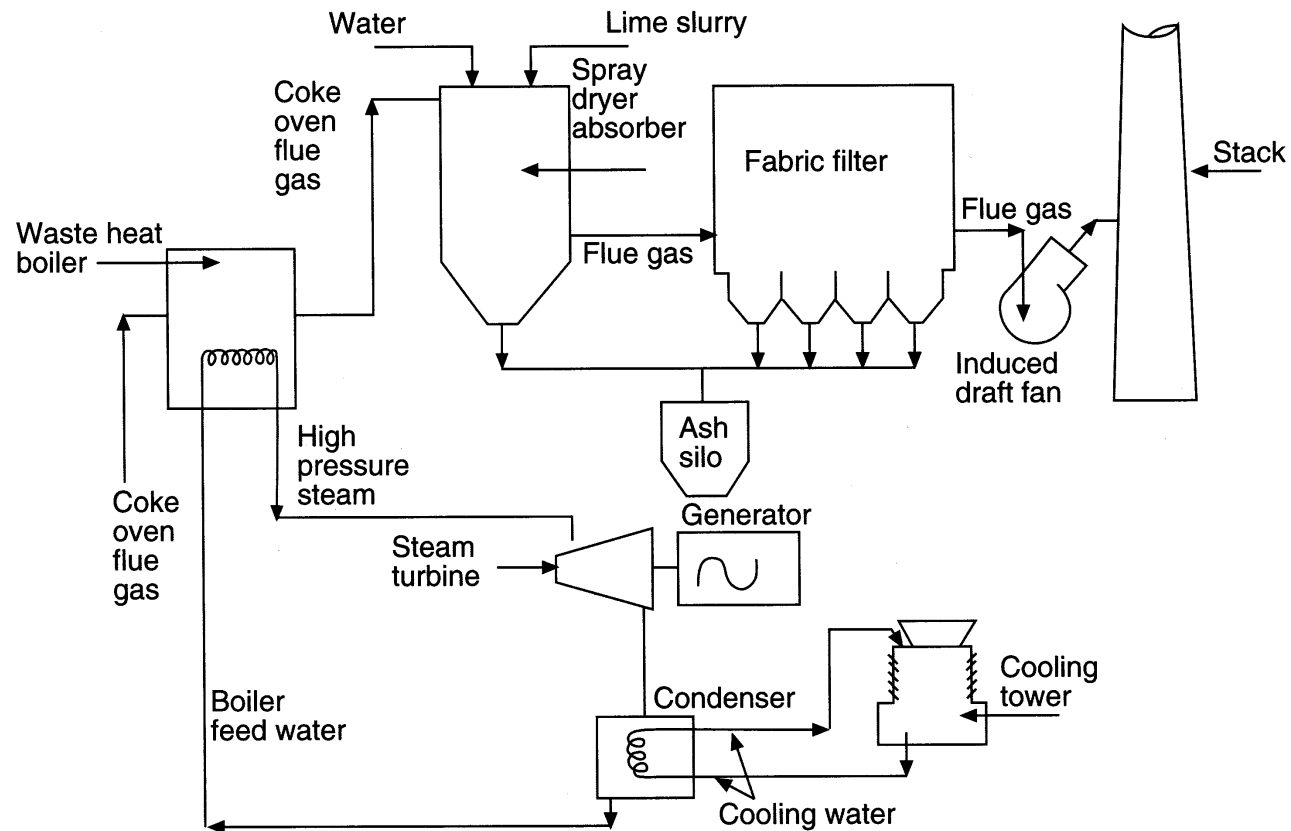
Coke Plant Process Flow Diagram



Recovering Waste Heat- Flue Gas Flow Diagram



Co-generation - Flow Diagram



Cogeneration power system.



ENVIRONMENTAL CONCERNS

Technology Overview - From an Environmental Perspective...

- Characterized by continuous operation under negative pressure
- Door leaks eliminated as an environmental issue
- Hazardous air pollutants (HAP's) are destroyed by thermal oxidation
 - over 5 seconds retention time at > 2200 F
- 1990 Clean Air Act - specifically references Jewell /Thompson Oven technology as MACT
- No wastewater generated from the process

Negative Pressure


- Non-recovery coke making is a negative pressure technology, resulting in the ambient air being pulled into the coke oven at any available intake point and thus eliminating any potential fugitive leaks.

EPA TESTING

- July 1991 - EPA conducted visible emissions testing at Sun's Jewell Facility. Out of the 116 test runs conducted on 7309 doors, no doors with VE were observed

EPA TESTING

- October-November 1991 - EPA conducted stack testing for the following pollutants
 - Particulate matter
 - Toluene soluble organic compounds
 - Condensable particulate matter
 - Multiple metals
 - Semi-volatile organic quantitative compounds
 - Volatile organic quantitative compounds
 - Continuous emissions monitoring for SO₂ , NO_x, and CO



The Jewell-Thompson non-recovery coke oven established the “Maximum Achievable Control Technology Standard” or MACT Standard for greenfield sites.

EPA COMMENT

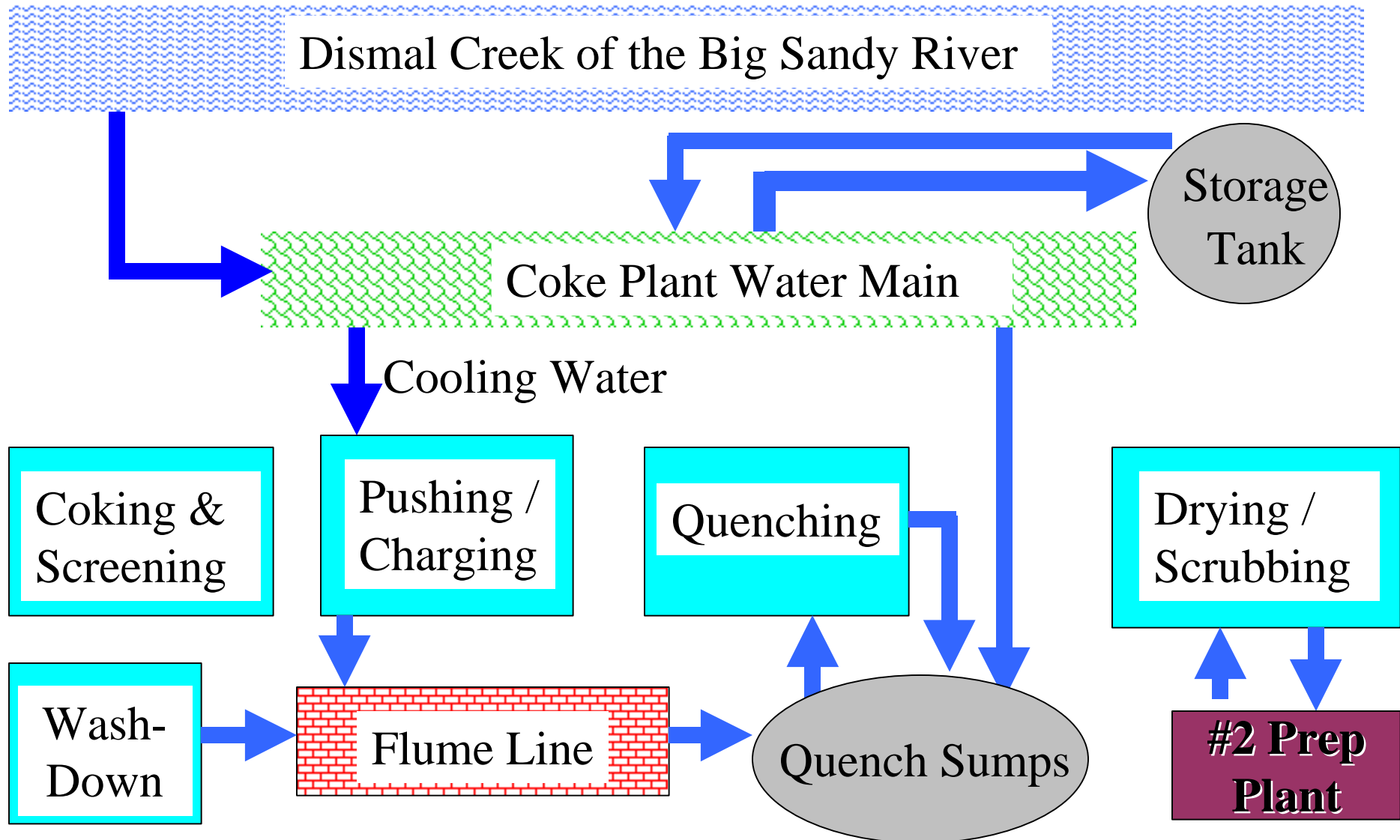
“The proposed MACT Standards for new coke oven batteries are based on the use of the nonrecovery process and would result in significant reductions of emissions if any new coke oven batteries are built. The test data currently available indicate that these standards will essentially eliminate emissions of BSO from coke plants if the standards are met by constructing nonrecovery coke oven batteries.”

*Federal Register. Vol. 57, No. 234.
Friday, December 4, 1992. Proposed Rules*

Water Usage at Jewell & IHCC

- The coke facilities are a net user of water.
- Since all conventional by-products are combusted during the coking process, no waste water streams are generated in the recovery of by-products.
- From the heat recovery facility, blowdown from boilers and cooling towers are the only effluent streams

Jewell Coal & Coke Water Usage



Heat Recovery Cokemaking - Capital Cost Summary

- 1.3 MM TPY plant w/ 90 MW Cogen
 - Coke Plant - \$200MM to 220MM including coal and coke handling facilities
 - Heat Recovery - \$120MM to 140MM